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## SOME STUDIES OF THE FECUNDITY OF THE APPLE-LEAF PLANT-LOUSE.

*Aphis mali* Fitch.

By F. M. WEBSTER.

Of the three principal species of Aphides infesting our smaller cereal grains, this species occupies an anomalous and at the same time important position. In point of numbers it is usually in advance of *Toxoptera graminum*, and, usually, of *Siphonophora avenæ*, and its effects on young wheat during the fall is, if anything more serious than either of the others, especially if the land be poor and the weather be dry. So far as my own observations go, it is more detrimental to the wheat than to the apple. The occurrence of the eggs on the twigs of apple, during winter, and the appearance of the young on the first tender buds and leaves in the spring, are familiar to all horticulturists. I have several times made the attempt to colonize the species on wheat plants, with individuals taken from the apple, but was never able to thoroughly succeed in this until this year, when a series of experiments was begun in the insectary which swept away any previous doubts on the subject of migrations.

Several years ago, on April 17th, all stages of *A mali* were found on the young buds of quince — a new food plant so far as published record goes — and being unrecognizable without the winged adults, the attempt was made to carry them on artificially until these would appear. In doing this a number escaped from the breeding cage where they were kept, and took up their abode on some young wheat, growing in a box on the same table. Not knowing with what generation I began investigating it on the quince, it is of course impossible to say whether, as with the Hop Aphis, it is not until the third brood is reached that adults attempt to escape to other plants, and if it was to this third brood to which the escaped individuals belonged. It will be only safe to say that they were winged and migrated. A wingless female from the quince also strayed from the cage and stationed herself on some of these wheat plants, and produced a number of young, but these all died and fell from the plants. At the same time, in a large cage out of doors, others of this species were being reared from the eggs on twigs of apple. Wheat was sown within this cage, and some of the winged adults, after leaving the young buds and

leaves, went first to the muslin sides of the cage and afterwards to the wheat plants. One of these remained for two weeks, alive, on one of the plants, but I could not see that she produced young. While these transitions were certainly made between the tree and grain plants, nature apparently chose to accomplish it only by her own methods, and would brook no interference or human assistance.

Early in March of the present year (1893) I placed in the insectary a couple of small seedling apple trees and to these bound twigs from the orchard, thickly stuck with eggs of this *Aphis mali*. In the same bench, about twenty feet away, wheat was sown, while some corn was planted in the intervening space. A pot containing a strawberry plant infested by another species of *Aphis*, and which were attended by ants, *Lasius flavus*, had previously been placed on this bench. With the hatching of the *mali* a large portion of the ants abandoned their wards on the strawberry and gave their attention to the new ones on the apple. The strawberry was then removed, but they still clung to their new found friends. As the population on the apple increased the ants distributed the apterous females to plants of *Poa*, *Setaria*, and *Ambrosia artemisiifolia*, but especially to the wheat, carrying them by the corn to the wheat beyond, which soon became overrun with aphids. Later, they began to colonize their wards on the corn, but this seemed to be less desirable than either the wheat or grass. Winged *mali* left the apple unaided, and after taking up their position on the wheat began their labor of reproduction. On this wheat being uprooted the indefatigable ants removed them to a few wheat plants still farther away from the apple.

The species also lives over winter in the wheat fields, at least during mild winters, and I have found females reproducing every month of the year. Here, in the west, when the young wheat comes up in September and October, the winged females appear on the plants and give birth to their young, and these crawling downward attach themselves to the stems just below the surface of the ground, or often on the roots themselves. Here they go on reproducing when the temperature is favorable, the adults being apterous, so far as observed by me, until spring, when they ascend to the foliage, the adults being after this both winged and wingless. On the stems and roots below the surface of the ground, they are of a greenish color tinged with a reddish brown, especially posteriorly, the full grown individuals often being wholly of a dark brown. It is during autumn that they do their greatest injury to wheat by sucking the juices from the young plants, often,

if on poor land and during dry weather, checking their growth and causing the foliage to turn yellow.

My previous experiments in rearing the species were in some respects unfortunate, in being interrupted, although there was some profit attached to the failures. The results, as well as the whole series of experiments, as they were carried out, are here given.

Infested wheat plants were taken from the field and placed in breeding cages, out of doors, April 5th. May 6th., from what appeared to be the second generation from the individuals from the fields, two pupæ were selected and isolated on wheat plants. On the 8th both began reproducing, but only one of them was retained, the other being destroyed. The retained female produced five young between 7.30 A. M. and 5.30 P. M. of the 8th, and 11 more up to 7.30 A. M. of the 9th. Six young were found on the morning of the 10th, five on the morning of the 11th, three on the morning of the 12th and three on the morning of the 13th, but the mother was nowhere to be found, she evidently having escaped from under the glass with which the plant was covered. Her progeny of the 8th, five in number, had been kept on a separate plant under another cover, and these, except one which was killed by accident, reached the adult stage on the 15th. Two of these were winged and two were wingless, and one of each produced young as follows:

May 15, winged female had produced 0 and wingless 8 young.

"	16	"	"	"	"	0	"	"	11	"
"	17	"	"	"	"	7	"	"	7	"
"	18	"	"	"	"	3	"	"	8	"
"	19	"	"	"	"	2	"	"	7	"
"	20	"	"	"	"	3	"	"	5	"
"	21	"	"	"	"	2	"	"	10	"
"	22	"	"	"	"	3	"	"	9	"
"	23	"	"	"	"	1	"	"	1	"
"	24	"	"	"	"	3	"			
"	25	"	"	"	"	0				
"	26	"	"	"	"	0				

The winged female died on the 26th, after producing 24 young in twelve days. The wingless female escaped on the 23rd, after producing 65 young in nine days.

Females were again secured and produced young on June 2nd, after which the parent was destroyed, the progeny themselves giving birth to young on the 8th. A wingless female was selected and reproduced as follows:

June 8, produced 7 young.

" 9	" 3	"
" 10	" 3	"
" 11	" 6	"
" 12	" 6	"
" 13	" 5	"
" 14	" 4	"
" 15	" 5	"
" 16	" 3	"
" 17	" 4	"

June 18, produced 1 young.

" 19	" 1	"
" 20	" 1	"
" 21	" 2	"
" 22	" 4	"
" 23	" 1	"
" 24	" 1	"
" 25	" 1	"
" 26	" 1	"

The female continued to live a few days longer but died without further issue, she having produced 59 young in 19 days.

The results of the rearing of this species show that, as with the others, the winged female is the least prolific. It is also probable that some individuals are more productive of young than others, and that the species as a whole may be more prolific early in the season than later on towards midsummer.

As a comparison of the rapidity with which the species multiplies I append the following record of similar experiments with the grain aphid, *Siphonophora avenæ*:

A female was isolated on a wheat plant May 5, and on the next day, having in the meantime given birth to four young, she was destroyed. On the 14th two of these were also destroyed, the remainder reaching maturity, one being winged and the other apterous. These were both kept on plants under glass, and carefully watched, with the following results, the young being destroyed as fast as produced:

May 15, winged female had produced 1 and wingless 6 young.

" 16	"	"	"	" 3	"	" 4	"
" 17	"	"	"	" 4	"	" 4	"
" 18	"	"	"	" 5	"	" 6	"
" 19	"	"	"	" 4	"	" 8	"
" 20	"	"	"	" 2	"	" 5	"
" 21	"	"	"	" 4	"	" 7	"
" 22	"	"	"	" 3	"	" 4	"
" 23	"	"	"	" 1	"	" 6	"
" 24	"	"	"	" 1	"	" 4	"
" 25	"	"	"	" 2	"	" 3	"
" 26	"	"	"	" 1	"	" 3	"
" 27	"	"	"	" 2	"	" 6	"
" 28	"	"	"	" 0	"	" 2	"
" 29	"	"	"	" 2	"	" 3	"

May 30, winged female had produced 3 and wingless 8 young.

"	31	"	"	"	"	1	"	"	2	"
June	1	"	"	"	"	0	"	"	2	"
"	2	"	"	"	"	0	"	"	0	"
"	3	"	"	"	"	1	"	"	1	"
"	4	"	"	"	"	0	"	"	3	"
"	5	"	"	"	"	0	"	"	2	"

The wingless female died on the 6th, but the winged female lived on, without issue, until the 11th of June. The period of reproduction being 19 days with the winged female and 21 days with the wingless, the former producing 40 and the latter 89 young.

I found that the young moulted on the second, and began reproducing either late on the seventh or early on the eighth day after birth. The insects and plants were inspected, and the young removed each morning, usually about 8 o'clock, so that the young were the production of the subsequent 24 hours.

## NOTES ON SPIDERS.

BY NATHAN BANKS.

The following pages embrace some miscellaneous notes on spiders of the U. S. First I have given a list of the genera and species omitted from Dr. Marx' Catalogue; next some of the works containing descriptions of new species that have been published since Dr. Marx' Catalogue. Quite a number of synonyms are given and some other notes on species, then follows some keys and descriptions of new species.

### GENERA OMITTED.

*Liocranoides* Keys. Neue Spinnen, III, 1881, place after *Phrurolithus*.

*Glenognatha* Simon. C. R. Ent. Soc. Fr., 1884, place after *Pachygnatha*.

*Myrmecarachne* Walsh. Proc. Am. Ent. Soc. 1864, = *Synemosyna*.

### SPECIES OMITTED.

*Actinopus audouini* Lucas. Ann. Ent. Soc. Fr., 1845, p. 60, Amerique du Nord.

*Micaria limnicune* McCook. Proc. Acad. Nat. Sc., 1884, Description worthless.